

# The flora of tidal forests – a rationalization of the use of the term ‘mangrove’

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Some difficulties attendant upon attempts to define a mangrove are discussed in the light of recently acquired knowledge of the floristic diversity of some tropical tidal swamps. Inconsistencies in the use of the term ‘mangrove’ are pointed out. It is suggested that in future, either a very broad definition of ‘mangrove’ be accepted or the use of the term be abandoned in favour of less equivocal terms. Lists of over 900 species which occur in tidal swamps in the Indo-West Pacific are appended. These exclude epiphytes.

*S. Afr. J. Bot.* 1985, 51: 77–99

Daar word op onreëlmatighede in die gebruik van die term ‘mangliet’ (of ‘wortelboommoeras’) gewys. Sommige probleme wat met pogings om ‘n mangliet te definieer saamgaan, word bespreek in die lig van kennis van die floristiese verskeidenheid van sommige getymoerasse wat onlangs verkry is. Daar word voorgestel dat daar in die toekoms óf ‘n baie breë definisie van ‘mangliet’ (of ‘wortelboommoeras’) aanvaar word, óf dat daar afstand gedoen word van die gebruik van die term ten gunste van minder onsekere terme. ‘n Lys van meer as 900 spesies wat in getymoerasse voorkom en nie epifiete insluit nie, word ook aangebied.

*S.-Afr. Tydskr. Plantk.* 1985, 51: 77–99

**Keywords:** Mangrove, swamp forest, tidal forest

## Introduction

Mangrove forests are generally considered to have discrete boundaries, and have long been regarded as having small specialized floras. Moreover, the term ‘mangrove forest’ has been widely, but only ostensibly, treated as if it were synonymous with the term ‘tidal forest’. However, our studies of Indo-West Pacific tidal forests, extending over a period of 29 years, have revealed the presence in them of more than 400 arborescent and 500 non-arborescent species (Appendices 1 & 2). This level of floristic diversity and the physical nature of some of the tidal basins prompts a re-evaluation of the mangrove concept. In view of the current surge of interest in mangrove vegetation, it seems appropriate to try to clarify the meaning of the term ‘mangrove’ and to remove some of the inconsistencies hitherto associated with its use.

The words ‘mangrove’ and ‘mangrove’ first came into English usage in the early 17th Century, c.1613, according to the *Oxford English Dictionary*. Earlier, in the Americas, the Spanish and Portuguese used the words ‘mangle’ and ‘mangue’, derived from an Haytian Arawak language, to refer to trees and shrubs of the genus *Rhizophora*. Later, in English, the word was modified to ‘mangrove’ and began to be applied to trees of other genera, e.g. *Avicennia*, *Laguncularia* and *Pelliciera*, which either grew with the rhizophoras or occupied the same type of habitat. A perusal of the literature indicates that by the middle of the 18th Century there was a widespread understanding that ‘mangroves’ were arborescent species forming forests in the tidal zones, and that such forests were best developed in the tropics.

Subsequently, it seems that British colonial administrators in India and S.E. Asia were primarily responsible for expanding the use of the word to describe two different things; tidal forests and the individual plants that grow in them, and the word came to have this dual meaning. Recently, however, some authors (e.g. Macnae 1968; Chapman 1976) have advocated using two separate terms, ‘mangal’ to describe the forest formation and ‘mangrove’ to indicate individual plants. This follows Portuguese and French practice where the terms ‘mangal’ and ‘mangue’ and ‘palétuvier’ and ‘manglier’ are used respectively to denote the forest community and the individual plants. However, although this practice may seem desirable, the authors who suggested it were themselves far from consistent in the matter, and as the word ‘mangal’ is absent from the bulk of the English literature we do not advocate its use.

It is clear from the literature that many botanists take the view that a ‘mangrove’ forest can be defined simply on the basis of its containing ‘mangrove species’, but that it need

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Accepted 15 December 1984



not be composed exclusively of such species. This would be acceptable if a satisfactory definition of a mangrove species were available, but it is not. Although the original meaning of the term was clear, referring to the species of a single genus (*Rhizophora*), the way in which the meaning was subsequently expanded to include species of other genera was both arbitrary and irrational. The question now arises as to what characteristics a plant must possess to qualify for the status of a mangrove.

### Attempts to define a 'mangrove species'

All recent interpretations of the term mangrove relate primarily to the tidal habitat of the species concerned, although secondary reference may be made to anatomical, morphological and physiological adaptations to that habitat. Attempts to define a mangrove as a particular type of plant, without reference to its habitat, have all been unsatisfactory because the features so often regarded as characteristic of mangroves are not exclusive to them and are therefore not truly diagnostic. Stilt roots and pneumatophores are often better developed in seasonal swamp forest trees than in mangroves, while viviparity is neither exhibited by all mangroves nor exclusive to mangroves, and the same is true for the ability to secrete salt. Moreover, despite the fact that the IUCN Commission on Ecology's, *World Working Group on Mangroves*, has recently stated that 'the actual species usually listed (as mangroves) are derived by wide consensus' (Saenger *et al.* 1983), this is in fact not so. Many authors are clearly uncertain as to whether or not they should designate a particular species a mangrove, and it is common to find that different authors claim that different numbers of mangrove species occur in the world, or even in their local regions. Walsh (1974), for example, puts the world total at 55, while Chapman (1976) considers there are as many as 90 species. Jones (1971) gives 27 mangrove species as being present in eastern Australia, while Bunt *et al.* (1982) using broader criteria, list 45 in the same region. Blasco *et al.* (1975) consider that there are 'between 50 and 60' species in India, while Rao & Sastry (1974) recognize more. The point here is that while new species are still being discovered in the tidal zone, not all botanists accept that these new species are mangroves. Views may be diametrically opposed, for example several authors have excluded the American species *Conocarpus erecta* from the mangrove category, e.g. Raunkaier (1934), while others have claimed that it is found exclusively in mangrove swamps, e.g. Walsh (1974), and neither view is correct. *Conocarpus erecta* is common in mangrove (tidal) swamps but not exclusive to them. This type of problem arises in part because authors are not fully acquainted with the ecology of a particular species.

Most modern authors, e.g. Chapman (1976), Bunt *et al.* (1982) and Saenger *et al.* (1983), admit the difficulties involved in defining a mangrove species, and since over the years it has proved impossible to define a mangrove in phenotypic terms it seems reasonable to conclude that the term is invalid in such a context. Today, most biologists concerned with mangroves claim to accept the view stated by Schimper (1891, 1898), and subsequently by several other authors, that mangrove forests are tidal forests. However, despite this they seem reluctant to take the pragmatic step of defining as a mangrove, any arborescent species growing in such a forest. To draw a parallel, it is a fact that if a species consistently grows in montane forest or dune forest its status as a 'montane forest species' or 'dune forest species' is unlikely to be challenged, but by contrast there can be no guarantee that a species which

consistently grows in tidal swamps will be accepted as a mangrove.

While Bunt & Williams (1980) apparently accepted the implications of Schimper's (1891) definition, they later qualified their view, for in 1982 (Bunt *et al.* 1982) they say they believe some degree of subjectivity is inevitable in defining a mangrove. They explain their new criteria of including a species as a mangrove if it is frequent in an area obviously subject to tidal inundation and grows in association with species whose 'mangrove' status has never been disputed. Essentially this means they regard a species as a mangrove if it grows among mangroves! But of course this still begs the question as to exactly what constitutes a mangrove.

The current situation wherein some species are classified as mangroves in a purely arbitrary way while others which seem equally well qualified, are not, is unacceptable. There must be some consistent rationale for using the term 'mangrove' and simply designating trees that grow in the tidal zone seems best. It would certainly simplify the situation if there were general acceptance of the view that any arborescent species was a mangrove when it was growing in a tidal area and not a mangrove when it was not. One could then say of a particular species that it was 'a potential mangrove' or 'frequently a mangrove'. It would be easy to recognize a mangrove in the field and since it is more convenient to say 'mangrove' than 'tree in the tidal zone' the term would be genuinely useful. However, it would be a contradiction in terms to talk of the 'inland occurrences of mangroves'. The following discussion, in support of this recommendation, examines some of the reasons why it appears impossible to unequivocally characterize a given species as a mangrove.

### Are mangrove species confined to the tidal zone?

Some authors contend that 'true' mangroves are species which occur exclusively in the tidal zone and the IUCN *World Working Group on Mangroves* has recently listed 60 such species (Saenger *et al.* 1983). However, few if any arborescent species are in fact confined to the tidal zone. Of those listed by Saenger *et al.* (1983), some, such as *Excoecaria agallocha*, *Heritiera littoralis* and *Lumnitzera racemosa*, are important components of the Indo-Pacific strand flora and the latter two occur above high tide level in littoral woodlands from the shores of Africa to those of Polynesia. In addition *Excoecaria agallocha* occurs on hillsides up to 415 m (1,361 ft) in Fiji (Smith 1981), *Heritiera littoralis* grows in hill forests to 450 m (1,476 ft) in Sri Lanka (Trimen 1893) and *Lumnitzera littorea* reaches an elevation of 330 m (1,082 ft) in Sarawak (Browne 1955). Further, there are numerous well known and reliable accounts of species of *Avicennia*, *Bruguiera*, *Rhizophora* and *Sonneratia* growing naturally above high tide level. For example, *Avicennia germinans* grows on low coastal hills in El Salvador and *Avicennia marina* has been reported many miles inland and well above sea level in Natal and Papua (Moldenke 1960a,b) and Western Australia (Beard 1967). *Rhizophora* spp. are found inland along several rivers on the northern coast of South America, including the Para River in Brazil (Chapman 1976), and together with *Avicennia germinans* and *Laguncularia racemosa* they also occur away from the sea on several Caribbean islands, e.g. Barbuda (Stoddart *et al.* 1973) and Inagua (Lugo 1981). *Bruguiera gymnorrhiza*, *Rhizophora mucronata* and *Sonneratia alba* grow inland in Micronesia, in what Fosberg (1975) termed 'mangrove depressions', and Brass (1938) recorded a species of *Sonneratia* 10 m above



mean sea level in Papua.

One cannot therefore justify the view that mangrove species are confined to the tidal zone. To qualify this idea by suggesting that mangroves are species 'virtually exclusive' to the tidal zone, as many authors have, is still fraught with problems. Even with this modifier many of the most 'popular' and undisputed mangroves would have to be excluded from the category and some highly contentious species might have to be admitted to it, as will become apparent later.

### Are mangrove species confined to saline habitats?

Many botanists consider only those trees which grow in saline tidal forests to be mangroves but several difficulties arise with this interpretation, among them that of deciding where the saline zone ends. This is easy to see on a steep shore, but where the coast is a low lying wetland or a tropical estuary, it may be virtually impossible because of the existence of brackish transition zones.

In many parts of the world, where rivers drain per-humid highlands, the efflux of fresh water from the rivers is so great that with the flood tide, river water backs up and inundates adjacent low lying land. With the ebb tide, the flood drains away leaving the land dry again. Every day vast areas are subject to this type of fresh water tidal flooding in Borneo, the Malay Peninsula, Sumatra and New Guinea, and also in parts of West Africa and South America (see e.g. Corner 1978). In such places the water flooding the tidal zones grades from fully fresh inland, to highly saline at the coast, with broad brackish transition zones in between. Ebb and flow in the fresh water tidal zones is just as regular and real as if it occurred on a sea beach; spring and neap tide limits occur just as they do on any shore. Tall forests normally occupy the fresh water tidal zones and are in places fully contiguous through the brackish zones to the salt water swamp forests of the coast. Where there has been no disturbance, forest physiognomy is usually quite similar throughout.

In the brackish transition zones of these estuarine forests, undisputed mangrove species grow amongst other species whose range extends farther upstream towards the fresh water tidal zones. For example, in western Malesia undisputed mangrove species of the genera *Aegiceras*, *Brownlowia*, *Bru-guiera*, *Camptostemon*, *Cynometra*, *Dolichandrone*, *Excoeca-ria*, *Heritiera*, *Nypa*, *Rhizophora*, *Scyphiphora*, *Sonneratia* and *Xylocarpus* may all, though not necessarily in one locality, be found growing in association with species such as *Barringtonia acutangula*, *Barringtonia conoidea*, *Cerbera odollam*, *Croton heterocarpus*, *Ficus microcarpa*, *Fissistigma manu-briatum*, *Gluta velutina*, *Horsfieldia irya*, *Inocarpus fagiferus*, *Intsia bijuga*, *Merope angulata*, *Millettia hemsleyana*, *Ochtho-charis borneensis*, *Ochthocharis javanicus*, *Oncosperma fila-mentosum*, *Pandanus affinis*, *Pandanus helicopus*, *Pandanus rostratus*, *Palaquium obovatum*, *Podocarpus polystachyos*, *Polyalthia sclerophylla*, *Pterocarpus indicus*, *Sapium indicum*, *Scolopia macrophylla*, *Syzygium densiflorum*, *Tarennia fragrans* and *Vitex clarkeana*, to name but a few. These latter species are all common in sites which are flooded by brackish water each day and one can reasonably ask why the former group are regarded as mangroves but the latter group as non-mangroves. If the criteria enunciated by Bunt *et al.* (1982) are applied they all qualify as mangroves. Moreover, several of these latter species, e.g. *Barringtonia conoidea* and *Pandanus helicopus*, are more closely tied to tidal areas, and experience more frequent inundation, than many stands of undisputed mangrove species.

Farther upstream, members of the brackish transition group

themselves enter zones where they grow amongst other species in fresh water tidal areas. While the number of species in mangrove forests is generally low it tends to increase wherever the influence of fresh water increases. Thus it is widely acknowledged that the landward fringe is floristically the richest part of any mangrove swamp (e.g. Merrill 1945; Macnae 1968) for this is where fresh water from the land seeps into the swamp soil. The extraordinary diversity of species seen in the fresh water reaches of tidal swamps in the ever-wet tropics may be seen simply as an extension of this phenomenon. Far more species can cope with waterlogged soils when salt is absent from the environment than when it is present. Hence where the adjacent lowland flora is very rich, as in Malesia, there are many lowland species which can invade the fresh water fringes of a swamp whether it is tidal or not. Many of these fresh water species have stilt roots or some other type of pneumatophore, and most occupy sites that are flooded every day. This situation is not unique to Malesia. Similar transition zones occur in estuaries in other parts of the world except that different spectra of fresh and brackish water species are involved. Should these species not also be regarded as mangroves since they grow in tidal forests? This is not a new idea. In a survey of Caribbean mangroves in 1945, Stehlé recognized that fresh water tidal forests (dominated by *Pterocarpus officinalis*) constituted the climax mangrove community in the wettest parts of that region.

In wet transition zones such as these, can a line be drawn at which species shall cease to be called mangroves? Either a particular level of salinity will have to be chosen arbitrarily or the landward extent of a particular species or group of species will have to be taken to define the inner boundary of the mangrove, and this would almost certainly be equally arbitrary. Despite this, many foresters and botanists in S.E. Asia regard either the back or the front of the *Nypa* zone as the landward boundary of a mangrove swamp, but on what criteria their judgements are based is not clear. Some undisputed mangrove species (e.g. *Sonneratia caseolaris*) which grow to seaward of *Nypa*, often also grow behind it, and whatever criteria are used this fact must invalidate the choice of *Nypa* as a boundary species.

Another difficulty relevant to the choice of suitable boundary species is that although many species are confined to particular parts of the salinity gradient in one area, they may exhibit quite different salinity 'preferences' in other geographic regions. This is possibly because physiological races exist in these species which confer different abilities to tolerate salt upon different populations. *Laguncularia racemosa*, *Lumnitzera* spp. and *Rhizophora mucronata* provide good examples, but to take an extreme case, *Nypa fruticans* occurs at the seaward face of mangroves at some sites in the Pacific, e.g. at the mouth of the Talofofo River in Guam, but over most of its range it is restricted to brackish back swamp environments.

Yet another difficulty is that saline water penetrates farther inland in drought periods than in rainy periods. This phenomenon is most marked where rainfall is highly seasonal, e.g. in northern Australia, Gambia and India, but even in the ever-wet climate of the Malay Peninsula and Borneo, wells along the lowland rivers tend to become saline if rain does not fall in the highlands for periods as short as 2–3 weeks. Since such short droughts may occur more than once each year, it may be assumed that even here saline water penetrates extra far inland more than once a year. Thus the boundary of the saline zone is inconstant. Furthermore, several species would transcend any such boundary if it could be drawn.



Being fully facultative halophytes, they occur throughout the forests from fresh water to saline sea water. *Aegiceras corniculatum* is such a plant, but there are others, and indeed it seems that no mangrove is an obligate halophyte.

Finally, it may be pointed out that many undisputed mangroves have been found growing naturally in fresh water conditions. Thus it certainly cannot be said that mangrove species necessarily occupy saline habitats.

### Is frequency of inundation a criterion for mangrove status?

On any shore (unless it coincides with an amphidromic point) the level reached by high water varies throughout the year. Theoretically the land reached by equinoctial spring high tides is flooded only twice a year, and immediately to seaward of this there is always an area which is regularly, but very infrequently, tidal. Examination of the vegetation in this latter area on most shores indicates that the influence of the tides is sufficient for it to be considered part of the tidal zone. It would therefore seem straightforward to accept the tidal zone as extending between the lowest water of the lowest spring tide and the highest water of the highest spring tide. But the matter is not this easily settled because occasional events can cause even higher or lower tides. Storms often induce tidal surges and if these coincide with high spring tides, they may result in dramatic tidal rises. If such events were rare and occurred perhaps only once a century, one might be able to disregard them as thoroughly aberrant phenomena, but in most parts of the world they are more frequent than this and some enhanced tidal rises are experienced every year. Thus, their effect on the vegetation is continual and since their magnitude is unpredictable, it is impossible to delineate the limit of tidal flooding on sloping shores precisely. The effects of storm-induced tidal surges may be very far-reaching if the slope of the shore is gentle. In Riau Province in southeastern Sumatra for example, where the coastal plain is 100 km wide and slopes seaward with a mean average gradient of only 1:20,000, an extra rise in sea level of 1 m would cause water to flood 20 km farther inland. Coastal slopes this gentle are not uncommon and cyclonic storms frequently enhance tidal rises by well over 1 m. Twelve tropical cyclones occurred in the Moçambique Channel during the first four months of 1984, several of which caused tidal rises of this magnitude on the west coast of Malagasy and down the East African coast between Tanzania and Natal.

On seasonally arid coasts, transitional zones occur between tidal and non-tidal forests in many infrequently flooded landward areas. The landward fringes of tidal swamps in these regions are often dry for much of the year and although the soils may be saline, they are frequently aerated to depths of half a metre or more, and some fresh water percolates from the land. Few botanists doubt that mangroves occur in such irregularly tidal situations. For example, on the East African coast, *Avicennia marina*, *Bruguiera gymnorhiza*, *Ceriops tagal* and *Lumnitzera racemosa* all occur in peripheral situations which are flooded only occasionally. In some sites, trees of the first two species are inundated less than once a year. However, these undisputed mangroves seldom grow in isolation on the tidal fringes and, between Transkei and Somalia, a good many trees and shrubs may be found in association with them on brackish soils pock-marked by crab holes. In S.E. Africa these species include *Acacia karroo*, *Apodytes dimidiata*, *Barringtonia racemosa*, *Brachylaena discolor*, *Canthium inerme*, *Chrysanthemoides monilifera*, *Erythrina lysistemon*, *Ficus natalensis*, *Ficus sur*, *Garcinia*

*livingstonei*, *Hibiscus tiliaceus*, *Mimusops caffra*, *Phoenix reclinata*, *Rapanea melanophloeos*, *Schinus terebinthifolius*, *Syzygium cordatum*, *Syzygium guineense* and *Voacanga thouarsii*, while in Kenya, *Acacia zanzibarica*, *Dobera glabra*, *Ehretia petiolaris*, *Flacourtia indica*, *Hibiscus tiliaceus*, *Hyphaene parvula*, *Salvadora persica*, *Sideroxylon diospyroides* and *Sterculia africana* may be found in these situations. Again, all these species qualify as mangroves if the criteria of Bunt *et al.* (1982) are applied. However, few people would consider them to be mangroves when found in the inland vegetational types of which they are more typical, which serves to emphasize the futility of thinking of mangroves in terms of particular species. Nevertheless it seems reasonable to say of these fringe species that they are 'occasional or potential mangroves', i.e. to acknowledge that they sometimes occur in the tidal zone.

Further, as Good (1974) pointed out while discussing the tropical strand flora, 'it is not easy to state which species properly compose that flora, because, among other things, there are so many borderline cases with the mangroves'. Throughout the world, where tidal swamps abut beach vegetation, there are innumerable cases of intergrading between the species of the swamp and those of littoral woodlands. Several widespread species are common in both habitats, e.g. *Cerbera manghas*, *Excoecaria agallocha*, *Heritiera littoralis* and *Lumnitzera racemosa* in the Indo-West Pacific. Other species occur principally in one habitat, but locally, may be important in the other. *Thespesia populnea*, for example, is found chiefly in littoral woodlands but in Saipan where the undisputed mangrove flora is depauperate and competition is consequently reduced, it is an important species in tidal forests. Moreover, several species from littoral woodlands have been grown successfully in experimental mangrove swamps, in sites receiving comparatively deep and regular inundation, e.g. *Terminalia catappa* and *Erythrina variegata* (Arroyo 1979). Clearly these species are also capable of growing as mangroves in the absence of competition.

Wherever the typical mangrove flora is depauperate, species from neighbouring habitats tend to move into the tidal areas and occupy niches elsewhere filled by undisputed mangroves. Thus in parts of the Ryu Kyu Archipelago, *Drypetes karapinensis* is a dominant tree both in the saline tidal forests and the adjacent lowland forests. In the tidal zone it grows together with undisputed mangroves and must surely be considered a mangrove itself. In high latitudes, e.g. on the southern coasts of Australia, where the undisputed mangroves are represented only by *Avicennia marina*, the invaders from the land are predominantly herbs and a low salt marsh vegetation develops over much of the tidal zone. However, even here some inland trees have entered the fringes of tidal swamps, e.g. *Melaleuca halmaturorum* and *Melaleuca ericifolia*.

Although many authors prefer not to regard fringe species as mangroves on the basis of their being only infrequently inundated, this appears to be unsound. Some, like *Barringtonia racemosa*, *Hibiscus tiliaceus*, *Phoenix reclinata* and *Voacanga thouarsii* also occur in situations where they are regularly inundated. *Hibiscus tiliaceus*, for example, occurs at the seaward face of tidal forests in several countries, including Transkei and south India. This plant cannot tolerate deep or prolonged inundation but it can grow very well where it is flooded shallowly every day. In any case, mere frequency of inundation would be a dubious criterion for deciding if plants were mangroves or not. Whatever frequency of inundation was chosen, a large number of fresh water tidal species would have to be admitted to the mangrove category,



while large stands of *Avicennia marina* and *Bruguiera gymnorrhiza* could not be regarded as constituting mangrove forests.

### Should herbs and climbers be regarded as mangroves?

Several authors (e.g. Chapman 1976; Bunt *et al.* 1982) include some herbs and climbers in their lists of mangrove species and so apparently subscribe to the view that such plants should qualify for mangrove status. Non-arborescent species are more numerous than arborescent species in Indo-West Pacific tidal swamps, as is apparent from Appendix 2, and preliminary observations suggest that this is also true for tidal forests of the American-West African formation. However, as the original meaning of the term 'mangrove' applied to arborescent species and since the great majority of authors have accepted this convention, it seems better to refer to herbs and climbers that grow in tidal forests as 'mangrove associates'. The only difficulty here is that some species which most often grow as scandent shrubs occasionally grow into small trees and *vice versa*. In such cases there seems no reasonable alternative but to call the plants mangroves when they are arborescent. In temperate regions, the tidal zones tend to be occupied by herbaceous vegetation and in these latitudes they are traditionally referred to as 'marshes' or 'salt marshes'. This terminology is so well established that it would surely be unwise to include herbaceous marsh vegetation in the mangrove category, for in this case one could make a case for calling all temperate salt marshes, mangroves. A separation on the basis of tropical and temperate formations could not be validly made because arborescent vegetation, comprising undisputed mangrove species, is widely distributed in the subtropics and enters temperate regions in S.E. Africa, Australia, New Zealand and Japan. In these latter places it is widely accepted that arborescent mangrove vegetation interdigitates with herbaceous salt marsh vegetation, as discussed by Chapman (1976).

### Inconsistencies in categorizing species as mangroves

It is apparent from the literature that many authors have very subjective views as to which species are mangroves and which are not, and that their ideas often have little to do with whether or not the species concerned grow in tidal zones. Thus several authors have excluded the pan-tropical species *Hibiscus tiliaceus* from the mangrove category even though it can tolerate highly saline soils and is probably more consistently present in tidal forests than any other arborescent species. Indeed, it is hard to find a large tidal forest anywhere in the world which does not somewhere contain trees of *Hibiscus tiliaceus*, while, by contrast, no pan-tropical species of *Avicennia* or *Rhizophora* are currently recognized.

In some places where strongly seasonal climates prevail, e.g. on the Ganges and Irrawaddy Deltas, large areas of land are tidal only during the rainy seasons; the tidal zones retreating seawards during the dry seasons. Areas may be tidal for only half the year. In such places the forests tend to be considered as mangrove forests or not, depending upon what species they comprise. In Puerto Rico and Bangladesh there are places where *Rhizophora* spp. form riparian forests which are hardly flooded during the dry seasons. This implies that if regular flooding occurs only during the wet seasons, then, in these places, *Rhizophora* spp. must predominantly be trees of fresh water tidal swamps. Can a tree be a mangrove if it is flooded tidally only for part of the year, and then only by fresh water? People do not question the mangrove status of *Rhizophora* spp. since it was for this genus that the name was first coined,

and so in this particular case the answer is yes. But this is not a unique case. Many species in monsoonal regions experience tidal flooding only by fresh water during the rainy seasons, e.g. *Amoora cucullata* on the Irrawaddy Delta. Paradoxically few authors would admit this species to the mangrove category.

### Conclusion

In the past, use of the term 'mangrove' has been inconsistent and confusing. In consequence, we advocate either abandoning it altogether, or reserving it exclusively to designate arborescent species when they occur in the tidal zone. One could then speak of 'fresh water mangroves' or 'saline water mangroves', as the case might be, where such precision was required. Species such as *Rhizophora mucronata* and *Nypa fruticans* could then be said to exhibit high fidelity as mangroves, since they are seldom found outside the tidal zone, while others such as *Acacia karroo* and *Phoenix reclinata* could be said to be only occasional mangroves, since they rarely grow in the tidal zone. Between these two extremes there appears to be a whole range of arborescent species which exhibit between them, an almost continuously varying degree of association with the tidal zone. We would prefer to regard all these as mangroves, but only when they are growing under tidal influence.

When referring to the forest associations of the tidal zone in which these trees (mangroves) grow, we advocate the use of direct descriptions such as 'tidal forest' or 'brackish-water tidal forest', since these descriptions are unequivocal.

It seems reasonable to use the term 'mangrove associate' to designate non-arborescent plants when they are associated with mangroves in the tidal zone, as we have suggested. However, some authors have used this term in a variety of other ways, but chiefly to designate those arborescent species which, while they occur in tidal swamps, also have a wide distribution in non-tidal habitats. But, at the risk of being pedantic, this presumes that these authors can define a mangrove species *per se*, and we believe that we have shown that this has not yet been done. Thus we suggest that the term 'mangrove associate' not be applied to arborescent species.

### Acknowledgements

We gratefully acknowledge the advice of Dr F. Getliffe-Norris (Natal) and Dr J.A. Jimenez (Costa Rica) who offered valuable comments on the manuscript, and Prof. O. Hilliard (Natal), Dr R.E. Holtum and Mr G. Lucas (Kew) who helped with some taxonomic matters associated with the preparation of the appendices.

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## Notes on the Appendices

Families are arranged in alphabetical order. If a species occurs in tidal swamps in a given region its presence is designated by a number in the appropriate column. The number corresponds to the geographic region, as does the column. The regions used are:

- 1 = East Africa + shores of Red Sea and islands of Indian Ocean.
- 2 = The Indian Region including Sri Lanka + shores of

the Arabian Sea and the Persian Gulf.

- 3 = S.E. Asia, from Burma to China, the Andaman + Nicobar Islands and Malesia including New Guinea.
- 4 = Australia + New Zealand.
- 5 = The islands of the Western Pacific including Taiwan, Japan, Fiji and Samoa.

If a species is naturalized in a region, this is indicated by an \* at the appropriate place in the tables. Species marked 1° are present on the islands of the Indian Ocean but not on the African mainland. All species are rooted on the forest floor.

## Appendix 1

Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E. Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5
<b>Acanthaceae</b>					
<i>Acanthus ebracteatus</i> Vahl			3	4	
<i>Acanthus ilicifolius</i> L.		2	3	4	5
<b>Aegialitidaceae</b>					
<i>Aegialitis annulata</i> R.Br.			3	4	5
<i>Aegialitis rotundifolia</i> Roxb.		2			
<b>Anacardiaceae</b>					
<i>Buchanania lucida</i> Bl.			3		
<i>Camposperma auriculata</i> Hook.f.			3		
<i>Camposperma brevipetiolata</i> Volken			3		5
<i>Camposperma coriacea</i> (Jack) H. Hallier			3		
<i>Camposperma minor</i> Corner			3		
<i>Dracontomelum mangiferum</i> Bl.			3		
<i>Gluta renghas</i> L.			3		
<i>Gluta velutina</i> Bl.			3		
<i>Mangifera foetida</i> Lour.		2	3		
<i>Schinus terebinthifolius</i> Raddi	1*				5*
<b>Annonaceae</b>					
<i>Fissistigma manubriatum</i> (Hook.f. & Th.) Merrill			3		
<i>Polyalthia sclerophylla</i> Hook.f. & Th.			3		
<i>Xylopia fusca</i> Maingay			3		
<b>Antoniaceae</b>					
<i>Norristia major</i> Soler.			3		
<b>Apocynaceae</b>					
<i>Alstonia macrophylla</i> Wall. ex G.Don			3		
<i>Alstonia pneumatophora</i> Backer ex den Berger			3		
<i>Alstonia scholaris</i> (L.) R.Br.		2	3		
<i>Alstonia spatulata</i> Bl.			3		
<i>Carissa bispinosa</i> (L.) Desf. ex Brenan	1				
<i>Carissa macrocarpa</i> (Ecklon) A.DC.	1				
<i>Cerbera floribunda</i> K.Schum.			3		5



Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E.Afr.	India	S.E.A.	Aust.	W.Pac.
(= potential mangroves)	1	2	3	4	5
<i>Cerbera manghas</i> L.			3		5
<i>Cerbera odollam</i> Gaertn.		2	3		
<i>Dyera lowii</i> Hook.f.			3		
<i>Lepiniopsis trilocularis</i> Mgf.					5
<i>Ochrosia oppositifolia</i> (Lam.) K.Schum.		2	3		5
<i>Strophanthus cumingii</i> A.DC.			3		
<i>Voacanga papuana</i> K. Schum.			3		
<i>Voacanga thouarsii</i> Roemer & J.A. Schultes	1				
<b>Aquifoliaceae</b>					
<i>Ilex cymosa</i> Bl.			3		
<b>Araliaceae</b>					
<i>Schefflera odorata</i> Merrill & Rolfe			3		
<i>Schefflera umbellifera</i> (Sonder) Baillon	1				
<b>Areaceae</b>					
<i>Arenga microcarpa</i> Beccari			3		
<i>Borassus aethiopium</i> Martelli	1				
<i>Borassus flabellifer</i> L.		2	3		
<i>Cocos nucifera</i> L.			3		5
<i>Corypha elata</i> Roxb.		2	3		
<i>Corypha utan</i> Lam.		2	3		
<i>Cyrtostachys lakka</i> Beccari			3		
<i>Hyphaene natalensis</i> Kuntze	1				
<i>Hyphaene parvula</i> Beccari	1				
<i>Licuala spinosa</i> Wurmb.			3		
<i>Metroxylon sagu</i> Rottb.			3		5
<i>Nypa fruticans</i> Wurmb.		2	3	4	5
<i>Oncosperma filamen- tosum</i> Bl.			3		
<i>Oncosperma horri- dum</i> (Griff.) Scheff.			3		
<i>Phoenix paludosa</i> Roxb.		2	3		
<i>Phoenix pulsilla</i> Gaertn.		2			
<i>Phoenix reclinata</i> Jacq.	1				
<i>Raphia australis</i> Oberm. & Strey	1				
<i>Salacca conferta</i> Griff.			3		
<b>Avicenniaceae</b>					
<i>Avicennia alba</i> Bl.			3		5
<i>Avicennia balanophora</i> Stapf. & Mold. ex Mold.				4	
<i>Avicennia eucalypti- folia</i> Zipp. ex Miq.			3	4	5
<i>Avicennia lanata</i> Ridley			3		
<i>Avicennia marina</i> (Forsk.) Vierh.					
var. <i>marina</i> (Forsk.) Vierh.	1	2	3		5
var. <i>acutissima</i> Stapf. & Mold. ex Mold.		2			
var. <i>anomala</i> Mold.				4	
var. <i>australasica</i> (Walp.) Mold.			3	4	
var. <i>rumphiana</i> (H.Hallier) Bakh.			3		
<i>Avicennia officinalis</i> L.		2	3		5
<b>Bignoniaceae</b>					
<i>Dolichandrone</i> <i>spathacea</i> (L.f.) K.Schum.		2	3	4	5
<b>Bischoffiaceae</b>					
<i>Bischoffia javanica</i> Bl.			3		5
<b>Bombacaceae</b>					
<i>Camptostemon philip- pinensis</i> (Vid.) Beccari			3		
<i>Camptostemon</i> <i>schantzii</i> Masters			3	4	
<i>Neesia kostermansiana</i> Soepdamo			3		
<i>Neesia malayana</i> Bakh.			3		
<b>Bonnetiaceae</b>					
<i>Ploiariium alternifolium</i> (Vahl) Melch.			3		
<b>Capparidaceae</b>					
<i>Capparis sepiaria</i> L.	1				
<b>Casuarinaceae</b>					
<i>Casuarina equisetifolia</i> L.	1	2	3		5
<i>Casuarina glauca</i> Sieber ex Sprengel				4	
<b>Celastraceae</b>					
<i>Cassine viburnifolia</i> (Juss.) Ding Hou		2	3		
<i>Lophopetalum multi- nervum</i> Ridley			3		
<i>Maytenus emarginata</i> (Willd.) Ding Hou		2	3	4	
<i>Maytenus procumbens</i> (L.f.) Loes.	1				
<i>Maytenus senegalensis</i> (Lam.) Exell	1°				
<i>Putterlickia verrucosa</i> (E.Mey. & Sond.) Szyszyl.	1				
<b>Chrysobalanaceae</b>					
<i>Parinari corymbosum</i> (Bl.) Miq.			3		
<b>Clusiaceae</b>					
<i>Calophyllum cholob- taches</i> Laut.					5
<i>Calophyllum inophyl- lum</i> L.	1°	2	3		5
<i>Calophyllum javani- cum</i> Miq.			3		
<i>Calophyllum kunstleri</i> King			3		



Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E.Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5

*Calophyllum retusum*

Wall. ex Planch. &

Triana

3

*Calophyllum rupi-*

colum Ridley

3

*Calophyllum scero-*

phyllum Vesque

3

*Calophyllum soulattri*

Burm.

2

3

5

*Garcinia bancana* Miq.

3

*Garcinia livingstonei*

T.Anders.

1

*Garcinia nervosa* Miq.

3

*Garcinia subtilinervis*

F.Muell.

3

*Mammea odorata*

(Raf.) Kosterm.

3

5

*Mesua ferruginea*

Pierre

2

3

#### Combretaceae

*Lumnitzera littorea*

(Jack) Voigt

2

3

4

5

*Lumnitzera racemosa*

Willd.

1

2

3

4

5

*Terminalia boivinii*

Tul.

1

*Terminalia brassii* Exell

5

*Terminalia canaliculata*

Exell

3

*Terminalia catappa* L.

3

*Terminalia phellocarpa*

King

3

*Terminalia subacropta*

Domin

4

*Terminalia triptera*

Stapf.

3

#### Compositae

*Brachylaena discolor*

DC.

1

*Chrysanthemoides*

monilifera (L.)

Nordlinh

1

*Pluchea indica* (L.)

Less.

2

3

5

#### Connaraceae

*Connarus salomonien-*

sis Schellenb.

3

5

#### Cornaceae

*Aralidium pinnati-*

fidum Miq.

3

#### Dilleniaceae

*Dillenia biflora*

(A.Gray) Mart. ex

Dur. & Jacks

5

*Dillenia castanaefolia*

(Miq.) Diels

3

*Dillenia papyracea*

Merrill

3

*Dillenia pulchella*

(Jack) Gilg.

3

*Dillenia suffruticosa*

(Griff.) Martelli

3

#### Dipterocarpaceae

*Vatica pauciflora*

(Korth.) Bl.

3

Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E. Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5

#### Ebenaceae

*Diospyros ferrea*

(Willd.) Bakh.

2

*Diospyros littorea*

(R.Br.) Kosterm.

3

4

*Diospyros inhacaensis*

F.White

1

#### Ehretiaceae

*Ehretia petiolaris* Lam.

1

#### Elaeocarpaceae

*Elaeocarpus griffithii*

A.Gray

3

*Elaeocarpus longifolius*

Bl.

3

*Elaeocarpus macro-*

cerus (Turcz.) Merrill

3

*Elaeocarpus robustus*

Roxb.

3

*Elaeocarpus sphaericus*

(Gaertn.) K.Schum.

2

3

#### Erythroxylaceae

*Erythroxylum*

cuneatum (Miq.)

Kurz

3

#### Euphorbiaceae

*Antidesma coriaceum*

Tul.

3

*Baccaurea bracteata*

M.A.

3

*Blumeodendron tok-*

brai (Bl.) J.J.Smith

3

*Bridelia micrantha*

(Hochst.) Baillon

1

*Claoxylon indicum*

(Reinw. ex Bl.)

Hassk.

2

3

*Croton heterocarpus*

M.A.

3

*Dimorphocalyx*

murinus Elm.

3

*Drypetes karapinensis*

Pax. & Hoffm.

5

*Endospermum macro-*

phyllum (M.A.) Pax.

& Hoffm.

5

*Excoecaria agallocha*

L.

1°

2

3

4

5

*Glochidion littorale* Bl.

2

3

*Glochidion mindorens*

C.B.Rob.

3

*Glochidion perakense*

Hook.f.

3

5

*Glochidion ramiflorum*

Forst.

5

*Macaranga baccaurei-*

folia Airy Shaw

3

*Macaranga capensis*

(Baillon) Benth.

1

*Macaranga pruinosa*

(Miq.) M.A.

3

*Macaranga tanarius*

(L.) M.A.

3

4

*Mallotus papillaris*

(Blanco) Merrill

3

*Mallotus tiliifolius*

(Bl.) M.A.

3

5



Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E.Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5
<i>Neoscortechinia</i> <i>forbesii</i> (Hook.f.) Pax. & S.Moore			3		5
<i>Neoscortechinia</i> <i>sumatrensis</i> S.Moore			3		
<i>Sapium indicum</i> Willd.		2	3		
<i>Suregada multiflora</i> (Juss.) Baillon		2	3		
<b>Fagaceae</b>					
<i>Lithocarpus benettii</i> (Miq.) Rehd.			3		
<i>Lithocarpus elegans</i> (Bl.) Hatus.			3		
<b>Flacourtiaceae</b>					
<i>Dovyalis longispina</i> (Harvey) Warb.	1				
<i>Flacourtia indica</i> (N.L.Burm.) Merrill	1				
<i>Homalium foetidum</i> (Roxb.) Benth.			3		
<i>Scolopia macrophylla</i> (Wight & Arn.) Clos			3		
<i>Scolopia zeyheri</i> (Nees) Harvey	1				
<b>Gyrocarpaceae</b>					
<i>Gyrocarpus americanus</i> Jacq.			3		5
<b>Hernandiaceae</b>					
<i>Hernandia nymphaei-</i> <i>folia</i> (Presl.) Kubitzki			3		5
<b>Hypericaceae</b>					
<i>Cratoxylum</i> <i>arborescens</i> (Vahl) Bl.			3		
<b>Icacinaceae</b>					
<i>Apodytes dimidiata</i> E.Meyer ex Arn.	1				
<i>Stemonurus ammu</i> (Kanehira) Sleumer				5	
<i>Urandra umbellata</i> Pulle			3		
<b>Ixonanthaceae</b>					
<i>Ixonanthes reticulata</i> Jack			3		
<b>Lauraceae</b>					
<i>Alseodaphne bancana</i> Miq.			3		
<i>Cryptocarya depressa</i> Warb.			3		5
<i>Cryptocarya kurzii</i> Hook.f.			3		
<i>Litsea cylindrocarpa</i> Gamble			3		
<i>Litsea palustris</i> Kosterm.			3		
<i>Notophoebe coriacea</i> Kosterm.			3		
<b>Lecythidaceae</b>					
<i>Barringtonia</i> <i>acutangula</i> (L.) Gaertn.					
ssp. <i>acutangula</i> Payens		2	3	4	

Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E. Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5
spp. <i>spicata</i> (Bl.) Payens			3		
<i>Barringtonia asiatica</i> (L.) Kurz			3		5
<i>Barringtonia conoidea</i> Griff.			3		
<i>Barringtonia filirachis</i> Payens			3		
<i>Barringtonia integri-</i> <i>folia</i> (Montr.) Schlechter					5
<i>Barringtonia nieden-</i> <i>zuana</i> (K.Schum.) Knuth			3		5
<i>Barringtonia papuana</i> Laut.			3		
<i>Barringtonia pterita</i> Merrill			3		
<i>Barringtonia procera</i> (Miers) Knuth			3		
<i>Barringtonia racemosa</i> (L.) Sprengel	1	2	3	4	5
<i>Barringtonia samoensis</i> A.Gray					5
<i>Barringtonia</i> <i>scortechinii</i> King			3		
<i>Planchonia papuana</i> Knuth			3		
<i>Planchonia timorensis</i> Bl.			3		
<b>Leeaceae</b>					
<i>Leea indica</i> (Burm.f.) Merrill			3		
<b>Leguminosae — Caesalpiinoideae</b>					
<i>Cassia alata</i> L.			3		5
<i>Cassia bicapsularis</i> L.	1				
<i>Crudia cynometriodes</i> Hosokawa					5
<i>Crudia wrayi</i> Prain			3		
<i>Cynometra bijuga</i> Spanoghe		2	3	4	
<i>Cynometra greenwayi</i> Brenan	1				
<i>Cynometra iripa</i> Kostel.		2	3	4	5
<i>Cynometra ramiflora</i> L.		2	3	4	
<i>Dialium patens</i> Baker			3		
<i>Intsia bijuga</i> (Colebr.) Kuntze	1°	2	3		5
<i>Intsia retusa</i> (Kurz.) Kuntze.			3		
<b>Leguminosae — Faboideae</b>					
<i>Desmodium umbel-</i> <i>latum</i> (Lour.) DC.	1°	2	3	4	5
<i>Erythrina fusca</i> Lour.			3		5
<i>Erythrina indica</i> Lam.		2			
<i>Erythrina lysistemon</i> Hutch.	1				
<i>Erythrina orientalis</i> (L.) Murr.			3		
<i>Erythrina variegata</i> L.	1	2	3	4	5
<i>Inocarpus fagiferus</i> (Parkinson) Fosb.			3		5
<i>Inocarpus papuanus</i> Kosterm.			3		
<i>Milletia hemsleyana</i> Prain			3		



Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E. Afr.	India	S.E.A.	Aust.	W.Pac.
<i>Pongamia pinnata</i> (L.) Pierre			3		5
<i>Pterocarpus indicus</i> Willd.		2	3		5
<i>Sesbania sesban</i> (L.) Merrill	1				
<b>Leguminosae — Mimosoideae</b>					
<i>Acacia auriculiformis</i> A.Cunn. ex Benth.			3	4	
<i>Acacia farnesiana</i> (L.) Willd.			3*		
<i>Acacia karroo</i> Hayne	1				
<i>Acacia zanzibarica</i> (S. Moore) Taub.	1				
<i>Adenanthera pavonina</i> L.		2	3		
<i>Albizia forbesii</i> Benth.	1		3		
<i>Albizia retusa</i> Benth.					
<i>Leucaena leucocephala</i> (Lam.) de Wit		2*			5*
<i>Prosopis juliflora</i> (Sw.) DC.	1*	2*			5*
<i>Prosopis spicigera</i> L.		2			
<b>Lythraceae</b>					
<i>Lagerstroemia ovali-</i> <i>folia</i> Teijsm. & Binn.			3		
<i>Pemphis acidula</i> J.R. & G.Forst.	1	2	3	4	5
<b>Magnoliaceae</b>					
<i>Talauma singapurensis</i> Ridley			3		
<b>Malvaceae</b>					
<i>Hibiscus hamabo</i> Sieb. & Zucc.					5
<i>Hibiscus tiliaceus</i> L.	1	2	3	4	5
<i>Plagianthus divaricatus</i> J.R. & G.Forst.				4	
<i>Thespesia acutiloba</i> (E.G.Baker) Exell & Mendon.	1°				
<i>Thespesia lampas</i> (Cav.) Dalz & Gibson	1	2	3	4	5
<i>Thespesia populnea</i> (L.) Solander ex Correa		2			5
<i>Thespesia populneoides</i> (Roxb) Kostel.	1°		3	4	
<b>Melastomataceae</b>					
<i>Ochthocharis borneen-</i> <i>sis</i> Bl.			3		
<i>Ochthocharis javanicus</i> Bl.			3		
<b>Meliaceae</b>					
<i>Amoora cucullata</i> Roxb.		2	3		
<i>Amoora rubiginosa</i> Hiern			3		
<i>Chisochiton amabilis</i> (Miq.) C.DC.			3		
<i>Dysoxylum costulatum</i> Miq.			3		
<i>Xylocarpus australa-</i> <i>sicus</i> Ridley			3	4	

Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E.Afr.	India	S.E.A.	Aust.	W.Pac.
<i>Xylocarpus gangeticus</i> Parkinson		2	3		
<i>Xylocarpus granatum</i> Koenig	1	2	3	4	5
<i>Xylocarpus mekongen-</i> <i>sis</i> Pierre		2	3		
<i>Xylocarpus moluccen-</i> <i>sis</i> (Lam.) M.Roem.	1	2	3		5
<b>Moraceae</b>					
<i>Artocarpus altilis</i> (Parkinson) Fosb.			3		5
<i>Ficus ampelos</i> Burm.f.					5
<i>Ficus aspera</i> Forst.f.					5
<i>Ficus austrina</i> Corner					5
<i>Ficus bambusifolia</i> Seem.					5
<i>Ficus benguetensis</i> Merrill					5
<i>Ficus caulocarpa</i> Miq.		2	3		5
<i>Ficus craterostoma</i> Warb.	1				
<i>Ficus erinobotrya</i> Corner					5
<i>Ficus fraseri</i> Miq.				4	5
<i>Ficus habrophylla</i> G.Bennett ex Seem.					5
<i>Ficus microcarpa</i> L.f.		2	3		5
<i>Ficus mollior</i> F.Muell. ex Benth.			3	4	5
<i>Ficus nodosa</i> Teijsm. & Binn.			3		5
<i>Ficus pritchardii</i> Seem.					5
<i>Ficus prolixa</i> Forst.f.					5
<i>Ficus retusa</i> L.			3		
<i>Ficus scabra</i> Forst.f.			3		5
<i>Ficus septica</i> Burm.f.			3	4	5
<i>Ficus sundaica</i> Bl.			3		
<i>Ficus sur</i> Forrsk.	1				
(syn. <i>Ficus capensis</i> )					
<i>Ficus sycamorus</i> L.	1				
<i>Ficus tinctoria</i> Forst.f.		2	3		5
<i>Ficus trichopoda</i> Baker	1				
<b>Myoporaceae</b>					
<i>Myoporum acumina-</i> <i>tum</i> R.Br.				4	
<i>Myoporum bontiodes</i> A.Gray					5
<i>Myoporum insulare</i> R.Br.			3	4	
<b>Myristicaceae</b>					
<i>Gymnacranthera</i> <i>eugeniifolia</i> (A.DC.) Sinclair			3		
<i>Horsfieldia irya</i> (Gaertn.) Warb.		2	3		5
<i>Horsfieldia polyantha</i> Warb.			3		
<i>Knema glaucescens</i> Jack			3		
<i>Knema intermedia</i> (Bl.) Warb.			3		
<i>Myristica elliptica</i> Hook.f. & Th.			3		
<i>Myristica guattariifolia</i> DC.			3		



Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E.Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5
<i>Myristica hollrungii</i> Warb.			3		5
<i>Myristica lowiana</i> King			3		
<b>Myrsinaceae</b>					
<i>Aegiceras corniculatum</i> (L.) Blanco		2	3	4	5
<i>Aegiceras floridum</i> Roemer & Schultes			3		
<i>Ardisia elliptica</i> Thunb.		2	3		
<i>Ardisia tuberculata</i> Wall.			3		
<i>Embelia ruminata</i> (E.Meyer ex A.DC.) Mez.	1				
<i>Myrsine umbellata</i> Martelli			3		
<i>Rapanea melanophloeos</i> (L.) Mez.	1				
<b>Myrtaceae</b>					
<i>Eugenia capensis</i> (Ecklon & Zeyher) Harv. & Sond.	1				
<i>Eugenia pseudosubtilis</i> King			3		
<i>Leptospermum scoparium</i> J.R. & G.Forst.				4	
<i>Melaleuca acaciodes</i> F.Muell.				4	
<i>Melaleuca cajuputi</i> Roxb.				3	4
<i>Melaleuca ericifolia</i> Sm.				4	
<i>Melaleuca halmaturo-</i> <i>rum</i> F.Muell. ex Miq.				4	
<i>Melaleuca leucaden-</i> <i>dron</i> L.			3	4	
<i>Melaleuca quin-</i> <i>quenervia</i> (Cav.) S.T.Blake				4	5
<i>Melaleuca squarrosa</i> Donn. ex Sm.				4	
<i>Melaleuca steno-</i> <i>stachya</i> S.T.Blake				4	
<i>Melaleuca viridiflora</i> Solander ex Gaertn.			3	4	
<i>Osbornia octodonta</i> F.Muell.			3	4	
<i>Pseudoeugenia</i> <i>singaporensis</i> King			3		
<i>Syzygium cordatum</i> Hochst.	1				
<i>Syzygium guineense</i> (Willd.) DC.	1				
<i>Syzygium incarnatum</i> (Elm.) Merrill & Perry			3		
<i>Syzygium leucoxylon</i> Korth			3		
<i>Syzygium muelleri</i> (Miq.) Miq.			3		
<i>Syzygium pachyphyl-</i> <i>lum</i> (Kurz) Merrill & Perry			3		
<i>Syzygium palembani-</i> <i>cum</i> Miq.			3		

Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E. Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5
<i>Syzygium papillosum</i> (Duthie) Merrill & Perry			3		
<i>Syzygium zeylanicum</i> (L.) DC.		2	3		
<i>Tristania sumatrana</i> Miq.			3		
<b>Naucleaceae</b>					
<i>Mitragyna speciosa</i> Korth.			3		
<i>Nauclea maingayi</i> Hook.f.			3		
<i>Nauclea orientalis</i> L.			3		
<i>Nauclea subdita</i> (Miq.) Merrill			3		
<i>Nauclea calycina</i> Merrill			3		
<b>Pandanaceae</b>					
<i>Pandanus affinis</i> Kurz			3		
<i>Pandanus atrocarpus</i> Griff.			3		
<i>Pandanus calathi-</i> <i>phorous</i> (Gaud. ex Hombron) Balfour f. ex Martelli					5
<i>Pandanus cominsii</i> Hemsley					5
<i>Pandanus compressus</i> Martelli					5
<i>Pandanus dubius</i> Sprengel			3		5
<i>Pandanus echino-</i> <i>dermops</i> Holttum & St. John			3		
<i>Pandanus flavicarpus</i> B.C.Stone					5
<i>Pandanus helicopus</i> Kurz			3		
<i>Pandanus kaernbachii</i> Warb.			3		5
<i>Pandanus kanehirae</i> Martelli					5
<i>Pandanus kirkii</i> Rendle	1				
<i>Pandanus malayanus</i> B.C.Stone			3		
<i>Pandanus nemoralis</i> Merrill & Perry					5
<i>Pandanus novo-iber-</i> <i>nicus</i> Martelli					5
<i>Pandanus odoratis-</i> <i>simus</i> L.f.	1°	2	3		
<i>Pandanus pedunculatus</i> R.Br.				4	5
<i>Pandanus polyacris</i> Martelli					5
<i>Pandanus polycephalus</i> Lam.					5
<i>Pandanus rabiensis</i> Rendle	1				
<i>Pandanus rostratus</i> Martelli			3		
<i>Pandanus rubellus</i> B.C.Stone					5
<i>Pandanus tectorius</i> Parkinson ex 'Z'			3	4	5
<i>Pandanus thwaitesii</i> Martelli		2			



Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E.Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5
<i>Pandanus yvanii</i> Solms.			3		
<b>Pittosporaceae</b>					
<i>Pittosporum ferruginea</i> Aiton			3		
<b>Podocarpaceae</b>					
<i>Podocarpus neriifolius</i> D.Don			3		
<i>Podocarpus poly- stachyus</i> R.Br.			3		
<b>Potaliaceae</b>					
<i>Fagraea blumei</i> G.Don			3		
<i>Fagraea crenulata</i> Maingay ex Clarke			3		
<i>Fagraea racemosa</i> Jack ex Wall.			3		
<b>Proteaceae</b>					
<i>Helicia robusta</i> (Roxb.) R.Br.			3		
<b>Rhamnaceae</b>					
<i>Colubrina asiatica</i> (L.) Brongn.	1	2	3	4	5
<i>Paliurus ramossissimus</i> Poir.					5
<b>Rhizophoraceae</b>					
<i>Bruguiera cylindrica</i> (L.) Bl.		2	3	4	
<i>Bruguiera exaristata</i> Ding Hou			3	4	
<i>Bruguiera gymnorrhiza</i> (L.) Lam.	1	2	3	4	5
<i>Bruguiera hainesii</i> C.G.Rogers			3		
<i>Bruguiera parviflora</i> (Roxb.) Wight & Arn. ex Griff.		2	3	4	
<i>Bruguiera sexangula</i> (Lour.) Poir.		2	3	4	5
<i>Carallia brachiata</i> (Lour.) Merrill			3		
<i>Ceriops decandra</i> (Griff.) Ding Hou		2	3	4	
<i>Ceriops tagal</i> (Perr.) var. <i>tagal</i> C.B.Rob var. <i>australis</i> C.T.White	1	2	3	4	5
<i>Gynotroches axillaris</i> Bl.			3		5
<i>Pellacalyx axillaris</i> Korth.			3		
<i>Kandelia candel</i> (L.) Druce		2	3		5
<i>Rhizophora apiculata</i> Bl.		2	3	4	5
<i>Rhizophora</i> × <i>lamarckii</i> Montr.			3	4	5
<i>Rhizophora mucronata</i> Lam.	1	2	3	4	5
<i>Rhizophora samoensis</i> (Hochr.) Salvoza					5
<i>Rhizophora</i> × <i>selala</i> (Salvoza) Tomlinson					5
<i>Rhizophora stylosa</i> Griff.			3	4	5

Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E. Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5
<b>Rubiaceae</b>					
<i>Canthium inerme</i> (L.f.) Kuntze	1				
<i>Canthium latifolium</i> F.Muell.				4	
<i>Canthium mundianum</i> Cham. & Schlechter	1				
<i>Gardenia jasminoides</i> Ellis					5
<i>Gardenia tubifera</i> Wall.			3		
<i>Guettarda speciosa</i> L.	1				
<i>Ixora grandifolia</i> Zoll. & Mor.			3		
<i>Ixora javanica</i> (Bl.) DC.			3		
<i>Kraussia floribunda</i> Harvey	1				
<i>Morinda citrifolia</i> L.			3		5
<i>Scyphiphora hydro- phyllacea</i> Gaertn.f.		2	3	4	5
<i>Tarenna fragrans</i> Bl.			3		
<i>Tarenna pavettoides</i> (Harvey) T.R.Sim	1				
<i>Timonius compressi- caulis</i> Boerl.			3		
<i>Timonius timon</i> (Sprengel) Merrill			3		
<i>Tricalysia sonderana</i> Hiern	1				
<b>Rutaceae</b>					
<i>Atalantia monophylla</i> DC.			3		
<i>Merope angulata</i> (Willd.) Swingle			3		
<b>Salvadoraceae</b>					
<i>Dobera glabra</i> (Forsk.) Poir.	1	2			
<i>Salvadora angustifolia</i> Turrill	1				
<i>Salvadora persica</i> L.	1	2			
<b>Sapindaceae</b>					
<i>Allophyllus cobbe</i> (L.) Raeusch.			3		
<i>Allophyllus natalensis</i> (Sonder) De Winter	1				
<i>Dodonaea viscosa</i> Jacq.	1	2		4	5
<i>Pometia pinnata</i> Forst.f.			3		
<b>Sapotaceae</b>					
<i>Ganua motleyana</i> (de.Vr.) Pierre ex Dubard			3		
<i>Madhuca longistyla</i> (King & Gamble) H.J.Lam			3		
<i>Madhuca tomentosa</i> H.J.Lam			3		
<i>Mimusops caffra</i> E.Meyer ex A.DC.	1				
<i>Palaquium macrocar- pum</i> Burck			3		
<i>Palaquium obovatum</i> (Griff.) Engler			3		
<i>Palaquium ridleyi</i> King & Gamble			3		



Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E.Afr.	India	S.E.A.	Aust.	W.Pac.
(= potential mangroves)	1	2	3	4	5
<i>Palaquium xanthochymum</i> (de Vr.) Pierre			3		
<i>Planchonella densinervia</i> (K.Krause) H.J.Lam			3		
<i>Planchonella linggensis</i> (Burck) Pierre			3		5
<i>Planchonella obovata</i> (R.Br.) Pierre		2	3		
<i>Sideroxylon inerme</i> L. var. <i>diospyroides</i> (Baker) J.H. Hemsley	1				
var. <i>cryptophlebium</i> (Baker) J.H. Hemsley	1°				
<b>Simaroubaceae</b>					
<i>Quassia indica</i> (Gaertn.) Noteboom		2	3		5
<b>Sonneratiaceae</b>					
<i>Sonneratia alba</i> J. Smith	1	2	3	4	5
var. <i>apetala</i> Buch.- Ham.		2	3	4	5
<i>Sonneratia caseolaris</i> (L.) Engl.		2	3	4	5
<i>Sonneratia ovata</i> Backer			3		
<b>Sterculiaceae</b>					
<i>Heritiera fomes</i> Buch.- Ham.		2			
<i>Heritiera globosa</i> Kosterm.			3		
<i>Heritiera littoralis</i> Aiton ex Dryander	1	2	3	4	5
<i>Kleinhovia hospita</i> L.	1	2	3		5
<i>Sterculia africana</i> (Lour.) Fiori	1				
<b>Strychnaceae</b>					
<i>Neuburgia corynocarpa</i> (A.Gray) Leenh.			3		
<i>Strychnos lucida</i> R.Br.				4	
<i>Strychnos spinosa</i> Lam.	1				
<b>Tamaricaceae</b>					
<i>Tamarix troupii</i> Hole.			3		
<b>Tetrameleaceae</b>					
<i>Octomeles sumatrana</i> Miq.			3		
<b>Theaceae</b>					
<i>Adinandra miquelii</i> King			3		
<b>Tiliaceae</b>					
<i>Althoffia pleiostigma</i> Warb. ex K.Schum. & Laut.			3		
<i>Brownlowia argentata</i> Kurz		2	3		
<i>Brownlowia tersa</i> (L.) Kosterm.		2	3		
<b>Urticaceae</b>					
<i>Pipturus velutinus</i> Wedd.					5

Arborescent species found growing in tidal zones in the Indo-West Pacific (= potential mangroves)	Regional occurrence				
	E. Afr.	India	S.E.A.	Aust.	W.Pac.
(= potential mangroves)	1	2	3	4	5
<b>Verbenaceae</b>					
<i>Clerodendrum inerme</i> (L.) Gaertn.		2	3	4	5
<i>Premna acuminata</i> R.Br.				4	
<i>Premna integrifolia</i> L.			3		5
<i>Premna obtusifolia</i> R.Br.	1°	2	3	4	5
<i>Premna tahitensis</i> Schau.			3		
<i>Teijsmanniodendron hollrungii</i> (Warb.) Kosterm.			3		
<i>Vitex clarkeana</i> Gamble			3		
<i>Vitex cofassus</i> Reinw. ex Bl.			3		5
<i>Vitex tangensis</i> Gurke	1				

## Appendix 2

Non-arborescent species  
found in tidal zones in  
the Indo-West Pacific  
region.

(potential mangrove  
associates)

C = climber

+ = may also grow as  
an epiphyte

	Regional occurrence				
	E.Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5
<b>Acanthaceae</b>					
C <i>Acanthus volubilis</i> Wall.		2	3		5
<i>Ruellia tuberosa</i> L.			3*		
<b>Aizoaceae</b>					
<i>Carpobrotus dimidiatus</i> (Haw.) L.Bolus	1				
<i>Carpobrotus rossii</i> Schwartz				4	
<i>Disphyma blackii</i> R.J.Chinnock				4	
<i>Lampranthus tegens</i> (F.Muell.) N.E.Br.				4	
<i>Sesuvium portulacastrum</i> L.	1	2	3	4	5
<i>Tetragonia tetragonoides</i> (Pallas) Kuntze	1				
<i>Trianthema turgidifolia</i> F.Muell.				4	
<b>Amaryllidaceae</b>					
<i>Crinum asiaticum</i> L.		2	3	?	5
<i>Crinum macowanii</i> Bak.	1				
<i>Crinum moorei</i> Hook.f.	1				
<i>Crinum paludosum</i> Verdoorn	1				
<i>Crinum pedunculatum</i> R.Br.				4	5
<i>Haemanthus magnificus</i> Herb.	1				

Non-arborescent species  
found in the tidal zones in  
the Indo-West Pacific  
region.

(potential mangrove  
associates)

C = climber

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an epiphyte

#### Regional occurrence

	E.Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5

#### Anacardiaceae

C *Rhus nebulosa*  
Schonl.

1

#### Annonaceae

C *Artabotrys mon-*  
*teiroa* Oliver

1

C *Monanthes affra* (Sonder)  
Verdc.

1

C *Uvaria kirkii*  
Hook.f.

1

#### Apiaceae

*Apium graveolens* L.

1

2

*Apium prostratum*

Labill. ex Vent.

4

#### Apocynaceae

C *Alyxia lucida* Wall.

3

C *Alyxia spicata* R.Br.

4

C *Parsonia helicandra*  
Hook. & Arn.

3

#### Araceae

*Aglaodorum griffithii*  
Schott

3

*Colocasia esculenta*  
Schott

2

3

5\*

*Cryptocoryne ciliata*  
Fisch. ex Schott

3

*Cryptocoryne*  
*cordata* Griff.

3

*Cryptosperma*  
*chamissonis*  
(Schott) Merrill

5

C *Epipremnum*  
*pinnatum* (L.)  
Engl.

3

5

*Homalomena grif-*  
*fithii* (Schott)  
Hook.f.

3

*Lasia aculeata* Lour

3

*Pistia stratiotes* L.

5

C *Pothos macrocephalus*  
Scortech.

3

C *Pothos scandens* L.

3

C *Rhaphidophora*  
*beccarii* Engl.

3

C *Rhaphidophora*  
*minor* Hook.f.

3

5

#### Araliaceae

C *Schefflera tomentosa*  
(Hassk.) Vig.

3

#### Arecaceae

C *Calamus aquatilis*  
Ridley

3

C *Daemonorops lep-*  
*topus* (Griff.)  
Martelli

3

#### Asclepiadaceae

C *Ceropegia tuberosa*  
Roxb.

2

Non-arborescent species  
found in the tidal zones in  
the Indo-West Pacific  
region.

(potential mangrove  
associates)

C = climber

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an epiphyte

#### Regional occurrence

	E.Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5

C *Cynanchum car-*  
*nosum* (R.Br.)  
Domin

4

C *Gymnanthera nitida*  
R.Br.

4

C *Hoya angustifolia*  
Elmer

3

C *Hoya merrillii*  
Schlechter

3

C *Hoya ridleyi* King &  
Gamble

3

C *Marsdenia thyrsi-*  
*flora* Hook.f.

3

C *Pentatropis capensis*  
(L.f.) Bullock

2

C *Pentatropis spiralis*  
Decne.

2

C *Sarcolobus carinatus*  
Wall.

2

3

C *Sarcolobus globosus*  
Wall.

2

3

C *Sarcolobus sul-*  
*phureus* Schlechter

5

C *Secamone delagoen-*  
*sis* Schlechter

1

C *Secamone frutescens*  
Decne.

1

C *Secamone gerrardii*  
Harvey ex Benth.

1

C *Tylophora indica*  
(Burm.f.) Merrill

2

C *Tylophora polyantha*  
Volkens

5

C *Tylophora tenuis-*  
*sima* (Roxb.)  
Wight & Arn. ex  
Wight

2

3

#### Barclayaceae

*Barclaya motleyi*  
Hook.f.

3

#### Batidaceae

*Batis argillicola*  
van Royen

4

*Batis maritima* L.

5\*

#### Blechnaceae

*Blechnum indicum*  
Burm.f.

3

*Blechnum orientale*  
L.

3

C *Stenochlaena*  
*palustris* (Burm.)  
Bedd.

1

2

3

4

5

#### Boraginaceae

*Heliotropium*  
*curassavicum* L.  
*Heliotropium ovali-*  
*folium* Forsskal

2

3

4

#### Cannaceae

*Canna indica* L.

3\*

5\*



Non-arborescent species  
found in the tidal zones in  
the Indo-West Pacific  
region.

(potential mangrove  
associates)

C = climber

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an epiphyte

Regional occurrence

E.Afr. India S.E.A. Aust. W.Pac.  
1 2 3 4 5

### Capparidaceae

C *Capparis cordifolia*  
Lam.

5

C *Capparis tomentosa*  
Lam.

1

### Caryophyllaceae

*Sagina maritima*

G. Don

4\*

*Spergularia media*  
(L.) C. Presl.

4\*

*Spergularia rubra*  
(L.) J. & C. Presl.

4\*

### Celastraceae

C *Loeseneriella*  
*macrantha*  
(Korth.) A.C.  
Smith

3

### Centrolepidaceae

*Centrolepis poly-*  
*gyna* (R.Br.)  
Hieron

4

### Ceratophyllaceae

*Ceratophyllum*  
*demersum* L.

4

### Chenopodiaceae

*Atriplex cinerea*  
Poir.

4

*Atriplex paludosa*  
R.Br.

4

*Atriplex patula* L.

1

4\*

*Atriplex semi-*  
*baccata* R.Br.

4

5

*Atriplex stipitata*  
Benth.

4

*Atriplex stocksii*  
Boiss

2

*Bassia astrocarpa*  
F. Muell.

4

*Chenolea diffusa*  
Thunb.

1

*Chenopodium*  
*glaucum* (R.Br.)  
Murr. & Thell. ex  
Thell.

4

*Enchylaena tomen-*  
*tosa* R.Br.

4

*Hemichroa diandra*  
R.Br.

4

*Hemichroa pentan-*  
*dra* R.Br.

4

*Maireana brevifolia*  
(R.Br.) P.G.  
Wilson

4

*Maireana oppositi-*  
*folia* (F. Muell.)  
P.G. Wilson

4

*Rhagodia baccata*  
(Labill.) Moq.

4

*Salsola baryosma*  
Dandy

2

Non-arborescent species  
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Regional occurrence

E.Afr. India S.E.A. Aust. W.Pac.  
1 2 3 4 5

*Salsola kali* L.

1

2

3

4

5

*Suaeda fruticosa*

Forssk

1

2

*Suaeda maritima*

(L.) Dumort. (inc.

*S. australis*)

1°

2

3

4

*Suaeda monoica*

Forssk

1

2

3

4

*Theleophyton bil-*  
*lardieri* (Moq.)

Moq.

4

*Threlkeldia diffusa*  
R.Br.

4

### Combretaceae

C *Combretum tetralo-*  
*phum* Clarke

3

### Commelinaceae

*Commelina bengha-*  
*lensis* L.

1

2

3

*Commelina com-*  
*munis* L.

5

*Commelina diffusa*  
Burm.f.

1

### Compositae

*Angianthus prei-*  
*sianus* (Steetz)

Benth.

4

*Aster squamatus*  
(Sprengel) Hieron

1

*Baccharis halmifolia* L.

4\*

*Blumea bifoliata* (L.)  
DC.

2

3

*Blumea diffusa*  
R.Br.

4

*Blumea mollis*  
(D. Don) Merrill

1

2

3

*Blumea obliqua*  
(L.) Druce

2

*Conyza bonariensis*  
(L.) Cronquist

1\*

*Conyza floribunda*  
H.B.K.

1\*

*Cotula coronopi-*  
*folia* L.

1

4

*Eclipta prostrata*  
(L.) L.

1

5

*Emilia baldwinii*  
Fosberg

2

*Emilia sonchifolia*  
(L.) DC.

2

5

*Ethulia conyzoides*  
L.

1

*Hypochoeris radi-*  
*cata* L.

1\*

4\*

*Lactuca serriola* L.

5\*

C *Mikania cordata*  
(Burm.f.) B.L.

1

3

*Nidorella auricu-*  
*lata* DC.

1

*Nidorella linifolia*  
DC.

1

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*Senecio laetus*

Forst.f. ex Willd.

*Sonchus oleraceus* L.

C *Wedelia biflora* (L.)

DC.

C *Wedelia chinensis*

(Osbeck) Merrill

#### Connaraceae

C *Connarus ferru-*  
*gineus* Jack

C *Connarus mono-*  
*carpus* L.

C *Connarus salomo-*  
*niensis* Schellenb.

C *Rourea mimosoides*  
(Vahl) Planchon

C *Rourea minor*  
(Gaertn.) Alston

#### Convolvulaceae

*Convolvulus jef-*  
*feryi* Verdc.

*Cressa cretica* L.

*Falkia repens* L.f.

C *Ipomoea alba* L.

*Ipomoea aquatica*

Forssk

C *Ipomoea cairica*  
(L.) Sw.

C *Ipomoea campanu-*  
*lata* L.

C *Ipomoea congesta* L.

C *Ipomoea digitata* L.

C *Ipomoea mauritiana*

Jacq.

C *Ipomoea littoralis* Bl.

C *Ipomoea macrantha*

Roemer & Schultes

*Ipomoea pes-caprae*

(L.) R.Br.

C *Ipomoea wightii*

(Wall.) Choisy

C *Stictocardia tiliifolia*

(Desr.) Hall.f.

C *Wilsonia backhousei*

Hook.f.

*Wilsonia humilis*

R.Br.

*Wilsonia rotundi-*  
*folia* Hook.

#### Costaceae

*Costus speciosus*

(Konig) Smith

#### Cucurbitaceae

C *Alsomitra macro-*  
*carpa* M.Roemer

C *Melothria madera-*  
*spatana* (L.) Cogn.

C *Melothria hetero-*  
*phylla* Cogn.

C *Momordica*  
*charantia* L.

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	1	2	3	4	5

C *Zehneria mucronata*

(Bl.) Miq.

#### Cymodoceaceae

*Amphibolis antarctica*

(Labill.) Sond. &

Asch. ex Asch.

*Amphibolis griffithii*

(J.M.Black) den

Hartog.

*Cymodocea rotun-*  
*data* Ehrenb. &

Hempr. ex Asch.

& Schweinf.

*Cymodocea serrulata*

(R.Br.) Asch. &

Magnus

*Halodule hawaiiiana*

Doty & Stone

*Halodule pinnifolia*

(Miki) den Hartog

*Halodule uninervis*

(Forssk) Asch.

*Syringodium isoeti-*  
*folium* (Asch.)

Dandy

*Thalassodendron*

*ciliatum* (Forsskal)

den Hartog

#### Cyperaceae

*Baumea juncea*

(R.Br.) Palla

*Bulbostylis barbata*

(Rottb.) C.B.

Clarke

*Cladium filum*

(Labill.) R.Br.

*Cladium mariscus*

(L.) Pohl.

*Cyperus alterni-*  
*folius* L.

*Cyperus aquatilis*

R.Br.

*Cyperus arenarius*

Retz.

*Cyperus articulatus* L.

*Cyperus cephalotes*

Vahl

*Cyperus compactus*

Retz.

*Cyperus compres-*  
*sus* L.

*Cyperus difformis* L.

*Cyperus exaltatus*

Retz.

*Cyperus halpan* L.

(syn. *C. haspan*)

*Cyperus javanicus*

Houtt.

*Cyperus ligularis* L.

*Cyperus malaccen-*  
*sis* Lam.

*Cyperus papyrus* L.



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	1	2	3	4	5
<i>Cyperus pedunculatus</i> (R.Br.) Kern	1	2	3	4	5
<i>Cyperus polystachyos</i> Rottb.	1	2	3	4	
<i>Cyperus scariosus</i> R.Br.		2	3	4	
<i>Cyperus stoloniferus</i> Retz.	1°	2	3	4	
<i>Cyperus textilis</i> Thunb.	1				
<i>Cyperus vaginatus</i> R.Br.				4	
<i>Eleocharis capitata</i> R.Br.		2			
<i>Eleocharis dulcis</i> (Burm.f.) Trin. ex Hensch.	1	2	3	4	5
<i>Eleocharis geniculata</i> (L.) Roemer & Schultes (doubtfully distinct from <i>E. capitata</i> )		2	3	4	
<i>Eleocharis spiralis</i> (Rottb.) Roemer & Schultes	1	2	3	4	
<i>Fimbristylis argentea</i> (Rottb.) Vahl		2	3		
<i>Fimbristylis caesia</i> Miq.			3		
<i>Fimbristylis cinnamomorum</i> (Vahl) Kunth			3		
<i>Fimbristylis complanata</i> (Retz.) Link			3		
<i>Fimbristylis costiglumis</i> Domin				4	
<i>Fimbristylis cymosa</i> R.Br. (syn. <i>F. spathacea</i> Roth.)			3	4	5
<i>Fimbristylis densa</i> S.T.Blake				4	
<i>Fimbristylis dichotoma</i> (L.) Vahl	1	2	3		
<i>Fimbristylis griffithii</i> Boeck		2	3		
<i>Fimbristylis microcarpa</i> F.Muell.			3	4	
<i>Fimbristylis nutans</i> (Retz.) Vahl		2	3	4	5
<i>Fimbristylis obtusifolia</i> (Lam.) Kunth	1				
<i>Fimbristylis pauciflora</i> R.Br.			3		5
<i>Fimbristylis polychaetoides</i> (Retz.) R.Br.	1		3	4	
<i>Fimbristylis punctata</i> R.Br.				4	
<i>Fimbristylis semarangensis</i> Ohwi			3		
<i>Fimbristylis sericea</i> R.Br.			3	4	5

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	E.Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5
<i>Fimbristylis sieberiana</i> Kunth	1	2	3	4	
<i>Fimbristylis thourarsii</i> (Kunth) Merrill			3		
<i>Fimbristylis tristachya</i> Thwaites		2			
<i>Fuirena umbellata</i> Rottb.		2	3		5
<i>Hypolytrum nemorum</i> (Vahl) Sprengel			3		
<i>Juncellus laevigatus</i> C.B.Clarke	1	2	3		5
<i>Lepironia articulata</i> (Retz.) Domin			3		5
<i>Mapania cuspidata</i> (Miq.) Uittien			3		5
<i>Mapania macrocephala</i> (Gaudich.) K.Schum.			3		5
<i>Mapania lorea</i> Uittien			3		
<i>Paramapania simplex</i> (Ridley) Uittien			3		
<i>Rhynchospora corymbosa</i> (L.) Britt.		2	3		
<i>Rhynchospora pterochaeta</i> F.Muell.				4	
<i>Rhynchospora rubra</i> (Lour.) Makino				4	
<i>Rhynchospora rugosa</i> (Vahl) Gale			3		
<i>Schoenus nitens</i> (R.Br.) Poir.				4	
<i>Scirpodendron ghaeri</i> (Gaertn.) Merrill		2	3	4	5
<i>Scirpus antarcticus</i> L.				4	
<i>Scirpus cernuus</i> Vahl	1			4	
<i>Scirpus lacustris</i> L.			3		5
<i>Scirpus litoralis</i> Schrad.	1	2	3	4	5
<i>Scirpus maritimus</i> L.		2	3	4	5
<i>Scirpus nodosus</i> Rottb.				4	
<i>Scleria angusta</i> Nees	1				
<i>Scleria corymbosa</i> Roxb.			3		
<i>Scleria papuana</i> Kern			3		
<i>Scleria parvula</i> Steudel			3		
<i>Scleria polycarpa</i> Boeck			3	4	5
<i>Thoracostachyum bancanum</i> (Miq.) Kurz			3		
<i>Thoracostachyum sumatranum</i> (Miq.) Kurz			3		

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	1	2	3	4	5

#### Dioscoraceae

C <i>Dioscorea crinata</i> Hook.f.	1				
C <i>Dioscorea sylvatica</i> Kunth	1	2	3		5

#### Euphorbiaceae

<i>Synostemon bacciformis</i> (L.) G.L. Webster	1°	2	3		
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#### Flagellariaceae

C <i>Flagellaria indica</i> L.			3	4	5
C <i>Flagellaria neo-caledonica</i> Schlechter					5

#### Frankeniaceae

<i>Frankenia pauciflora</i> DC.				4	
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#### Gentianaceae

<i>Centaurium pulchellum</i> (Sw.) Druce				4*	
<i>Centaurium spicatum</i> (L.) Fritsch				4	
<i>Sebaea albidiflora</i> F.Muell.				4	

#### Goodeniaceae

<i>Selliera radicans</i> Cav.				4	
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#### Haloragidaceae

<i>Myriophyllum elatinooides</i> Gaudich.				4	
<i>Myriophyllum siamense</i> (Craib) Tard.-Blot			3		

#### Hanguanaceae

<i>Hanguana malayana</i> (Jack) Merrill		2	3		5
--	--	---	---	--	---

#### Heliconiaceae

<i>Heliconia indica</i> Lam.			3		5
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#### Hemionitidaceae

<i>Pityrogramma calomelanos</i> (L.) Link			3		
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#### Hydrocharitaceae

<i>Enhalus acoroides</i> (L.f.) L.C.Rich.	1°	2	3	4	5
<i>Halophila decipiens</i> Ostenf.		2	3	4	5
<i>Halophila minor</i> (Zoll.) den Hartog	1	2	3	4	5
<i>Halophila ovalis</i> (R.Br.) Hook.f.	1	2	3	4	5
<i>Halophila spinulosa</i> (R.Br.) Asch.			3	4	
<i>Hydrilla verticillata</i> (L.f.) Royle	1	2	3	4	
<i>Thalassia hemprichii</i> (Ehrenb.) Asch.	1	2	3	4	5

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	E.Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5

#### Hydrocotylaceae

<i>Hydrocotyle capillaris</i> F.Muell.				4	
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#### Juncaceae

<i>Juncus maritimus</i> Lam.	1	2		4	5
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#### Juncaginaceae

<i>Triglochin bulbosa</i> L.	1				
<i>Triglochin mucronata</i> R.Br.				4	
<i>Triglochin striata</i> Ruiz & Pavon	1	2		4	

#### Lauraceae

C <i>Cassytha filiformis</i> L.	1	2	3	4	5
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#### Leguminosae — Caesalpinioideae

C <i>Caesalpinia bonduca</i> L. syn. <i>C. bonducella</i> Flemming	1	2	3	4	5
C <i>Caesalpinia crista</i> L. syn. <i>C. nuga</i> Aiton		2	3		5

#### Leguminosae — Faboideae

C <i>Abrus precatorius</i> L.	1	2	3		5
<i>Canavalia rosea</i> (Sw.) DC. syn. <i>C. maritima</i> (Aublet) Thouars	1	2	3	4	5
<i>Crotalaria mucronata</i> Desv.			3		
<i>Crotalaria striata</i> Roxb.			3		
C <i>Dalbergia armata</i> E.Meyer	1				
C <i>Dalbergia beccarii</i> Prain			3		
C <i>Dalbergia candenatensis</i> (Dennst.) Prain		2	3		5
C <i>Dalbergia obovata</i> E.Meyer	1				
C <i>Dalbergia palauensis</i> Hosokawa					5
C <i>Dalbergia parviflora</i> Roxb.			3		
C <i>Dalbergia spinosa</i> Roxb.		2			
C <i>Derris heptaphylla</i> (L.) Merrill			3		
C <i>Derris malaccensis</i> Prain			3		
C <i>Derris trifoliata</i> Lour. syn. <i>D. uliginosa</i> (Willd.) Benth.	1	2	3	4	5
<i>Melilotus indica</i> (L.) All.				4*	
C <i>Mucuna gigantea</i> DC.			3		5
C <i>Mucuna novoguineensis</i> Scheffer			3		



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### Leguminosae — Mimosoideae

C	<i>Acacia kraussiana</i> Meissner ex Benth.	1				
C	<i>Entada phaseoloides</i> Merrill			3		5
C	<i>Entada pursaetha</i> DC.	1				

### Lemnaceae

	<i>Lemna minor</i> L.			3		
	<i>Spirodela polyrrhiza</i> (L.) Schleiden		2	3		

### Liliaceae

C	<i>Gloriosa superba</i> L.	1	2	3		
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### Lycopodiaceae

	<i>Lycopodium</i> <i>cernuum</i> L.			3		
--	--	--	--	---	--	--

### Malpighiaceae

C	<i>Tristellateia australasica</i> A.Rich			3		5
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### Malvaceae

	<i>Hibiscus surattensis</i> L.	1				
	<i>Plagianthus spicatus</i> (Hook.) Benth.				4	

### Marantaceae

	<i>Clinogyne dichotoma</i> Salsb.			3		
	<i>Donax canniformis</i> K.Schum.			3		

### Melastomataceae

C	<i>Medinilla scandens</i> King			3		
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### Moraceae

C	<i>Cardiogyne africana</i> Bur.	1				
C	<i>Ficus globosa</i> Bl.			3		
C	<i>Ficus microscyca</i> Ridley			3		

### Myrsinaceae

C	<i>Maesa insularis</i> Gillespie					5
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### Najadaceae

	<i>Najas browniana</i> A.B.Rendle			3		
	<i>Najas marina</i> L.	1	2	3		

### Nepenthaceae

C	<i>Nepenthes mirabilis</i> Druce			3		
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### Nyctaginaceae

C	<i>Pisonia aculeata</i> L.	1	2	3		
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### Nymphaeaceae

	<i>Nymphaea capensis</i> Thunb.	1			4	
	<i>Nymphaea gigantea</i> Hook.			3	4	
	<i>Nymphaea stellata</i> Willd.		2	3		

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	<i>Nymphaea violacea</i> Lehmann					4
--	-------------------------------------	--	--	--	--	---

### Oleaceae

C	<i>Jasminum bifarium</i> Wall.			3		5
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### Oleandraceae

+	<i>Nephrolepis exaltata</i> Schott	1°				
+	<i>Nephrolepis oblitterata</i> (R.Br.) Carr					4

### Onagraceae

	<i>Ludwigia adscendens</i> (L.) Hara	1	2	3		4
--	---	---	---	---	--	---

### Orchidaceae

C+	<i>Arachnis flos-aeris</i> Reichb.f.				3	
C+	<i>Arachnis hookeriana</i> Reichb.f.				3	
C+	<i>Arachnis maingayi</i> Schlechter				3	
	<i>Eulophia keithii</i> Ridley				3	
+	<i>Pholidota imbricata</i> (Roxb.) Lindl.				3	
	<i>Platylepis glandulosus</i> (Lindl.) Reichb.f.	1				
+	<i>Pomatocalpa siamensis</i> (Rolfe ex Downie) Summerh.				3	
C	<i>Renanthera histriónica</i> Reichb.f.				3	
C	<i>Thrixspermum amplexicaule</i> (Bl.) Reichb.f.				3	

### Parkeriaceae

	<i>Ceratopteris thalictroides</i> (L.) Brongn.	1°	2	3		5
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### Passifloraceae

C	<i>Passiflora foetida</i> L.					3*
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### Periplocaceae

C	<i>Finlaysonia obovata</i> Wall.		2	3		5
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### Plantaginaceae

	<i>Plantago coronopus</i> L.					4*
	<i>Plantago lanceolata</i> L.	1				4

### Plumbaginaceae

	<i>Limonium australe</i> (R.Br.) Kuntze					4
	<i>Limonium binervosum</i> (G.E.Smith) C.E.Salmon					4*
	<i>Limonium psilocladon</i> (Boiss.) Kuntze					4*

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1 2 3 4 5

*Limonium salicor-  
neacea* (F.Muell.)  
Kuntze

4

# Poaceae (Gramineae)

*Aeluropus lago-  
poides* (L.) Trin.

1

2

*Agrostis billardieri*  
R.Br.

4

*Apluda mutica* L.  
*Brachiaria mutica*  
(Forssk.) Stapf

2

3

5

*Capillipedium par-  
viflorum* (R.Br.)  
Stapf

5

*Cenchrus biflorus*  
Roxb.

2

*Cenchrus ciliaris* L.

1

*Chloris barbata* (L.)  
Sw.

3\*

*Coelachne pulchella*  
R.Br.

3

4

*Coelachne simpli-  
cuscuscula* (Wight &  
Arn.) Munro ex  
Benth.

2

3

*Coelorachis glan-  
dulosa* Stapf ex  
Ridley

3

*Coix lacryma-jobi* L.

3

*Cymbopogon vali-  
dus* Stapf ex Burt  
Davy

1

*Cynodon dactylon*  
(L.) Pers.

1

2

3

5

*Dactyloctenium*  
*aegyptium* (L.)  
Beauv.

1

2

*Dactyloctenium*  
*geminatum* Hackel

1

*Digitaria ciliaris*  
(Retz.) Koeler

1

2

3

5

*Digitaria dispar*  
Henrard

3

*Digitaria littoralis*  
Stent

1

*Digitaria violascens*  
Link

5

*Diplachne fusca* (L.)  
P.Beauv.

2

3

*Distichlis disticho-  
phylla* (Labill.)  
Fassett

4

*Echinochloa colona*  
(L.) Link

3

5

*Echinochloa crus-  
galli* (L.) P.Beauv.

2

3

*Echinochloa haplo-  
clada* Stapf

1

*Echinochloa stagnina*  
(Retz.) Beauv.

3

*Eriachne pallescens*  
R.Br.

2

3

4

Non-arborescent species  
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Regional occurrence

E.Afr. India S.E.A. Aust. W.Pac.  
1 2 3 4 5

*Eriochloa procera*  
(Retz.) Hubbard

3

*Heteropogon contor-  
tus* (L.) Beauv.  
ex Roemer &  
Schultes

2

3

*Hordeum marinum*  
Hudson

4\*

*Hymenachne acuti-  
gluma* (Steudel)  
Gilliland

2

3

*Ischaemum muticum* L.

2

3

5

*Ischaemum poly-  
stachyum* J. & C.  
Presl.

3

5

*Leersia hexandra* Sw.

3

*Leptochloa chinensis*  
(L.) Nees

3

*Leptochloa poly-  
stachya* Benth.

2

*Lepturus repens*  
(G.Forst.) R.Br.

2

3

5

*Lolium loliaceum*  
(Bory & Chaub.)  
Hand.

4\*

*Miscanthus floridu-  
lum* (Labill.)  
Warb. ex Schum.  
& Laut.

5

*Myriostachya*  
*wightiana* (Nees ex  
Steudel) Hook.f.

2

3

*Panicum deustum*  
Thunb.

1

*Panicum humidorum*  
Buch.-Ham. ex  
Hook.f.

2

3

*Panicum paludosum*  
Roxb.

2

3

4?

*Panicum pinnifolium*  
Chiov.

1

*Panicum repens* L.

3

5

*Paraphlois incurva*  
(L.) C.E.Hubbard

4\*

*Paspalum conjuga-  
tum* Bergius

3

*Paspalum distichum*  
L. syn. *P. vagina-  
tum* Sw.

1

2

3

4

5

*Pennisetum poly-  
stachyon* (L.) J.A.  
& J.H.Schultes

4

*Periballia minuta*  
(L.) Asch. &  
Graebn.

4\*

*Phragmites australis*  
(Cav.) Trin. ex  
Steudel

1

4

*Phragmites japonica*  
(Trin.) Steudel

5

*Phragmites karka*  
(Retz.) Trin. ex  
Steudel

1

2

3

4

5



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	E.Afr. 1	India 2	S.E.A. 3	Aust. 4	W.Pac. 5
<i>Porteresia coarctata</i> (Roxb.) Tateoka		2	3		
<i>Pseudopogonatherum irritans</i> (R.Br.) A.Camus			3	4?	
<i>Pseudoraphis spinescens</i> (R.Br.) Vickery		2	3	4?	
<i>Puccinellia stricta</i> (Hook.f.) C.Blom				4	
<i>Saccharum arundinaceum</i> Retz.			3		
<i>Saccharum robustum</i> Brandes & Jesw. ex Grassl			3		5?
<i>Saccharum spontaneum</i> L.			3		
<i>Setaria geniculata</i> (Lam.) P.Beauv.		2	3		
<i>Setaria glauca</i> (L.) P.Beauv.		2	3		5
<i>Setaria pallide-fusca</i> (Schumach.) Stapf & C.E.Hubbard	1			4	
<i>Sorghum nitidum</i> Pers.			3		
<i>Spartina maritima</i> C.E.Hubbard	1*			4*	
<i>Sphaerocaryum malaccense</i> (Trin.) Pilger			3		
<i>Sporobolus virginicus</i> (L.) Kunth	1	2	3	4	5
<i>Stenotaphrum micranthum</i> (Desv.) Hubbard	1°	2			5
<i>Stenotaphrum secundatum</i> (Walter) Kuntze	1	2			
<i>Stipa teretifolia</i> Steudel				4	
<i>Themeda novoguineensis</i> (Reeder) Jansen			3		
<i>Themeda villosa</i> (Poir.) A.Camus			3		
<i>Thuarea involuta</i> (Forst.f.) R.Br. ex Roemer & Schultes	1°	2			5
<i>Urochondra setulosa</i> (Trin.) Hubbard	1	2			
<i>Vetiveria elongata</i> (R.Br.) Stapf ex C.E.Hubbard				4	
<i>Xerochloa barbata</i> R.Br.				4	
<i>Zoysia macrostachya</i> Franchet & Sav.					5
<i>Zoysia macrantha</i> Desv.				4	
<i>Zoysia matrella</i> (L.) Merrill		2	3		

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	E.Afr. 1	India 2	S.E.A. 3	Aust. 4	W.Pac. 5
<b>Polygonaceae</b>					
<i>Polygonum blumei</i> Meissner					5
<i>Rumex crispus</i> L.	1*				5*
<b>Pontederiaceae</b>					
<i>Monochoria hastata</i> (L.) Solms.			3		
<b>Portulacaceae</b>					
<i>Portulaca lutea</i> Solander ex Forst.					5
<i>Portulaca oleracea</i> L.		2			5
<i>Portulaca pilosa</i> L.					5
<b>Posidoniaceae</b>					
<i>Posidonia australis</i> Hook.f.				4	
<b>Potaliaceae</b>					
C <i>Fagraea ridleyi</i> King & Gamble			3		
<b>Potamogetonaceae</b>					
<i>Potamogeton crispus</i> L.	1	2	3	4	
<i>Potamogeton javanicus</i> Hassk.		2	3		5
<i>Potamogeton pectinatus</i> L.	1		3	4	5
<b>Primulaceae</b>					
<i>Samolus junceus</i> R.Br.				4	
<i>Samolus porosus</i> (L.f.) Thunb.	1				
<i>Samolus repens</i> (Forst. & Forst.f.) Pers.				4	
<b>Pteridaceae</b>					
<i>Acrostichum aureum</i> L.	1	2	3		5
<i>Acrostichum speciosum</i> Willd.			3	4	5
<i>Pteris ensiformis</i> Burm.			3		
<b>Restionaceae</b>					
<i>Leptocarpus elatior</i> R.Br.				4	
<i>Leptocarpus simplex</i> A.Rich.				4	
<i>Leptocarpus spathaceus</i> R.Br.				4	
<b>Rhamnaceae</b>					
C <i>Scutia myrtina</i> (N.L. Burm.) Kurz	1				
C <i>Smythea lanceata</i> (Tul.) Summerh.	1°	2			5
C <i>Ziziphus calophylla</i> Wall.	1				
<b>Rubiaceae</b>					
C <i>Canthium guenzii</i> Sonder	1				

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	1	2	3	4	5

C	<i>Gynochthodes sublanceolata</i> Miq.		3		
C	<i>Lecananthus erubescens</i> Jack		3		
C+	<i>Lucinaea morinda</i> DC.		3		
C	<i>Morinda umbellata</i> L.		3		
C	<i>Randia longifolia</i> Lam.		3		
C	<i>Tarenna junodii</i> (Schinz) Bremek.	1			
C	<i>Uncaria acida</i> Roxb.		3		
C	<i>Uncaria attenuata</i> Korth.		3		
C	<i>Uncaria pedicellata</i> Roxb.		3		
C	<i>Uncaria scleroptera</i> Roxb.		3		
N.B. some authorities place <i>Uncaria</i> in Naucleaceae.					

**Ruppiaceae**

<i>Ruppia maritima</i> L.	1	2	3	4	5
<i>Ruppia spiralis</i> L. ex Dumort.	1		3	4	

**Salicorniaceae**

<i>Arthrocnemum arbusculum</i> (R.Br.) Moq.				4	
<i>Arthrocnemum glaucum</i> (Del.) Ung.-Sternb.	1				
<i>Arthrocnemum halecnemoides</i> Nees				4	
<i>Arthrocnemum indicum</i> (Willd.) Moq.	1	2	3		
<i>Arthrocnemum leiostachyum</i> Benth.				4	
<i>Halocnemum strobil- laceum</i> (Pallas) M.Bieb.	1	2			
<i>Halopeplis perfoliata</i> (Forrsk.) Bunge ex Schweinf.	1	2			
<i>Salicornia blackiana</i> Ulbrich				4	
<i>Salicornia brachiata</i> Roxb.		2			
<i>Salicornia meyerana</i> Moss	1				
<i>Salicornia pachy- stachya</i> Bunge ex Ung.-Sternb.	1				
<i>Salicornia quinque- flora</i> Bunge ex Ung.-Sternb.			3	4	5
<i>Sarcocornia natalen- sis</i> (Bunge ex Ung.-Sternb.) A.J.Scott	1				

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	E.Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5

(syn. <i>Arthrocnemum natalense</i> )					
<i>Sarcocornia perennis</i> (Miller) A.J.Scott	1				
(syn. <i>Arthrocnemum perenne</i> )					
<i>Sarcocornia pillansiae</i> (Moss) A.J.Scott	1				
(syn. <i>Arthrocnemum pillansii</i> )					
<i>Tecticornia australa- sica</i> (Moq.) P.G. Wilson (syn. <i>Tecti- cornia cinerea</i> )			3	4	

**Schizaeaceae**

C <i>Lygodium dimor- phum</i> Copeland			3		
C <i>Lygodium trifur- catum</i> Bak.					5

**Scrophulariaceae**

<i>Herpestis monniera</i> H.B.K.			3		5
<i>Limnophila erecta</i> Benth.			3		
<i>Mimulus repens</i> R.Br.				4	

**Smilacaceae**

C <i>Smilax australis</i> R.Br.				4	
C <i>Smilax kraussiana</i> Meissner	1				
C <i>Smilax latifolia</i> R.Br.				4	

**Sphenocleaceae**

<i>Sphenoclea zeylanica</i> Gaertn.		2			
--	--	---	--	--	--

**Taccaceae**

<i>Tacca leontopeta- loides</i> (L.) Kuntze			3		5
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**Thelypteridaceae**

<i>Ampelopteris proli- fera</i> (Retz.) Copeland			3	4	
<i>Cyclosorus interrup- tus</i> (Willd.) H.Ito			3		5

**Typhaceae**

<i>Typha angustata</i> Bory & Chau.					5*
<i>Typha domingensis</i> Pers.	1	2		4	5
<i>Typha orientalis</i> Presl.			3		
<i>Typha latifolia</i> L.	1			4	

**Umbelliferae (see Apiaceae)****Urticaceae**

C <i>Poikilospermum cordifolium</i> (Barg.-Petr.) Merrill			3		
---	--	--	---	--	--



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	1	2	3	4	5
C <i>Poikilospermum suaveolens</i> (Bl.) Merrill			3		
<b>Verbenaceae</b>					
C <i>Prema trichostoma</i> Miq.			3		
<b>Vitidaceae</b>					
C <i>Cayratia carnosa</i> Gagnepain			3		
C <i>Cayratia trifolia</i> (L.) Domin				4	
C <i>Columella trifolia</i> Merrill			3		
C <i>Rhoicissus digitata</i> (L.f.) Gilg. & Brandt	1				
C <i>Rhoicissus tomentosa</i> (Lam.) Willd. & R.B. Drumm.	1				
C <i>Vitis furcata</i> Lam.			3		
<b>Xyridaceae</b>					
<i>Xyris complanata</i> R.Br.			3		
<i>Xyris indica</i> L.		2			
<i>Xyris pauciflora</i> Willd.			3	4	

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	E.Afr.	India	S.E.A.	Aust.	W.Pac.
	1	2	3	4	5
<b>Zanichelliaceae</b>					
<i>Zanichellia palustris</i> L.	1		3	4	
<b>Zingiberaceae</b>					
<i>Alpinia purpurata</i> (Vieill.) K.Schum.					5
<i>Alpinia zerumbet</i> (Pers.) Burt & R.M.Smith					5
<i>Curcuma longa</i> L.			3		
<i>Zingiber zerumbet</i> L.					5*
<b>Zosteraceae</b>					
<i>Heterozostera tasmanica</i> (Martens ex Aschers) den Hartog				4	
<i>Zostera capensis</i> Setchell	1				
<i>Zostera capricorni</i> Aschers				4	
<i>Zostera mucronata</i> den Hartog				4	
<i>Zostera muelleri</i> Irmisch ex Aschers				4	
<b>Zygophyllaceae</b>					
<i>Nitraria schoberi</i> L.				4	
<i>Tribulus cistoides</i> L.					5
<i>Zygophyllum alba</i> L.f.	1				